Claims

1. (Cancelled) Cancel Claim 1 without prejudice.

2. (Currently Amended) An apparatus for transducing an acoustic signal produced by a source, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from a long to a short, the apparatus comprising:

a. an array of at least two pressure sensors spaced apart along a sensor axis and located at an array location;

b. a loudspeaker that is configured to output sound waves in response to an input, at a loudspeaker location that is on the sensor axis;

c. a first signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to an estimate of a pressure derivative approximately along the sensor axis, at the array location;

d. a second signal processor, having an input that is coupled to an output of the first signal processor, and having an output that is coupled to the loudspeaker input, which second signal processor is configured to generate an output signal that is proportional to the estimate of derivative signal;

~~The apparatus of claim 1, further comprising:~~

~~a~~ e. a third signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to a weighted source pressure sum;

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b f. a comparator, coupled to an output of the third signal processor that generates the weighted pressure sum signal, configured to generate a pressure sum error signal that corresponds to whether the pressure sum signal is less than a threshold signal ε; and

e g. a fourth signal processor, coupled to an output of the comparator, configured to generate a coefficient signal based on the pressure sum error signal, which coefficient signal is input to the second signal processor which is further configured to generate an output signal that is proportional to the estimate of derivative signal, with a proportionality that is based on the coefficient signal.

3. (Original) The apparatus of claim 2, the fourth signal processor configured to generate a coefficient signal that results in the pressure sum being no greater than the threshold signal ε.

4. (Original) The apparatus of claim 2, the fourth signal processor coupled to an output of the array further configured to generate the signal that corresponds to pressure sum as a sum of equally weighted outputs of sensors of the array.

5. (Original) The apparatus of claim 2, the fourth signal processor coupled to an output of the array further configured to generate the signal that corresponds to pressure sum as a sum of unequally weighted outputs of sensors of the array.

6 - 15. (Cancelled) Please cancel claims 6-15 without prejudice.

16. (Original) The apparatus of claim 5, further comprising a source input portion, the pressure sensor

array and loudspeaker arranged such that the loudspeaker is more distant from the source input portion than is the array, the weighted pressure sum being chosen to establish a directional sensitivity to the pressure sensor array to discriminate in favor of sound coming from the direction of the source input portion.

17. (Original) The apparatus of claim 16, the weighted pressure sum being chosen to establish a cardioid directional sensitivity.

18. (Original) The apparatus of claim 16, the array comprising an array of three sensors, the weighted pressure sum being chosen to establish a superdirectivity substantially as shown in Fig. 12.

19. (Original) The apparatus of claim 16, the array comprising an array of at least two sensors, the weighted pressure sum being chosen to establish a superdirectivity.

20. (Original) The apparatus of claim 16, the weighted pressure sum comprising a frequency dependent weighting.

21 – 42. (Cancelled) Please cancel claims 21-42 without prejudice.

43. (Currently amended) A telephone handset for transducing a talker's speech, into a telephone transmission, the handset comprising:

      a. a housing having a talker signal input portion;

      b. an array of at least two pressure sensors, spaced apart along a sensor axis that passes through the talker signal input portion, arranged at an array location;

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c. a loudspeaker at a loudspeaker location that
is on the sensor axis and more distant from the talker
signal input portion than it is from the array
location;

d. a first signal processor, coupled to an
output from the array of pressure sensors, configured
to generate a signal that corresponds to an estimate
of a pressure derivative approximately along the
sensor axis, at the array location;

e. a second signal processor, having an input
that is coupled to an output of the signal processor
that generates an estimate of derivative signal, and
having an output that is coupled to the loudspeaker
input, which signal processor is configured to
generate an output signal that is proportional to the
estimate of derivative signal. The handset of claim
42, further comprising;

a f. a third signal processor, coupled to an
output from the array of pressure sensors, configured
to generate a signal that corresponds to a weighted
talker pressure sum;

b g. a comparator, coupled to an output of the
third signal processor that generates the weighted
pressure sum signal, configured to generate a pressure
sum error signal that corresponds to whether the
pressure sum signal is less than a threshold signal ε;
and

e h. a fourth signal processor, coupled to an
output of the comparator, configured to generate a
coefficient signal based on the pressure sum error
signal, which coefficient signal is input to the
second signal processor which is further configured to

generate an output signal that is proportional to the
estimate of derivative signal with a proportionality
that is based on the coefficient signal.

44. (Original) The handset of claim 43, the fourth
signal processor configured to generate a coefficient
signal that results in the pressure sum being no greater
than the threshold signal ε.

45. (Original) The handset of claim 43, the fourth
signal processor coupled to an output of the array further
configured to generate the signal that corresponds to
pressure sum as a sum of equally weighted outputs of
sensors of the array.

46. (Original) The handset of claim 43, the fourth
signal processor coupled to an output of the array further
configured to generate the signal that corresponds to
pressure sum as a sum of unequally weighted outputs of
sensors of the array.

47-55. (Cancelled) Cancel claims 47-55 without
prejudice.

56. (Original) The handset of claim 46, further
comprising a talker input portion, the pressure sensor
array and loudspeaker arranged such that the loudspeaker is
more distant from the talker input portion than is the
array, the weighted pressure sum being chosen to establish
a directional sensitivity to the pressure sensor array to
discriminate in favor of sound coming from the direction of
the talker input portion.

57. (Original) The handset of claim 56, the weighted
pressure sum being chosen to establish a cardioid
directional sensitivity.

58. (Original) The handset of claim 56, the array comprising an array of three sensors, the weighted pressure sum being chosen to establish a superdirectivity substantially as shown in Fig. 12.

59. (Original) The handset of claim 56, the array comprising an array of at least two sensors, the weighted pressure sum being chosen to establish a superdirectivity.

60. (Original) The handset of claim 56, the weighted pressure sum comprising a frequency dependent weighting.

61-77. (Cancelled) Cancel claims 61-77 without prejudice.

78. (Currently amended) An apparatus for transducing an acoustic signal produced in an acoustic medium by a source, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from a long to a short, the apparatus comprising:

 a. an acceleration sensor, located at a sensor location, arranged to sense acceleration of the medium, along a line and to generate a signal that corresponds to acceleration of the acoustic medium along the line;

 b. a loudspeaker that is configured to output sound waves in response to an input, at a loudspeaker location that is spaced from the sensor location along the line;

 c. an amplifying signal processor, having an input that is coupled to the acceleration sensor, which amplifying signal processor is coupled to an input of the loudspeaker, and configured to generate an output signal that is proportional to the acceleration signal;

~~a~~ <u>d</u>. an array of at least two pressure sensors spaced apart along a sensor axis and located at an array location that is spaced from the loudspeaker location along the line;

~~b~~ <u>e</u>. a sum signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to a weighted source pressure sum;

~~c~~ <u>f</u>. a comparator, coupled to an output of the sum signal processor that generates the weighted pressure sum signal, configured to generate a pressure sum error signal that corresponds to whether the pressure sum signal is less than a threshold signal ε; and

~~d~~ <u>g</u>. a coefficient signal processor, coupled to an output of the comparator, configured to generate a coefficient signal based on the pressure sum error signal, which coefficient signal is input to the amplifying signal processor, which is further configured to generate an output signal that is proportional to the estimate of derivative signal with a proportionality that is based on the coefficient signal.

79-82. (Cancelled) Cancel claims 79-82 without prejudice.

83. (Original) The apparatus of claim 78, at least one of the pressure sensors comprising a microphone.

84. (Original) The apparatus of claim 78, at least one of the pressure sensors comprising a hydrophone.

85-86. (Cancelled) Cancel claims 85-86 without prejudice.

87. (Currently amended) An apparatus for transducing an acoustic signal produced by a source, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from a long to a short, the apparatus comprising:

a. an array of at least two pressure sensors spaced apart along a sensor axis and located at an array location;

b. a loudspeaker that is configured to output sound waves in response to an input, at a loudspeaker location that is on the sensor axis;

c. a first signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to an estimate of a pressure derivative approximately along the sensor axis, at the array location;

d. a second signal processor, having an input that is coupled to an output of the first signal processor that generates an estimate of pressure derivative signal, and having an output that is coupled to the loudspeaker input, which second signal processor is configured to generate an output signal that causes the loudspeaker to draw in any volume velocity fluctuations that are produced by the source;

~~The apparatus of claim 86, further comprising:~~

~~a~~ e. a third signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to a weighted source pressure sum;

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b f. a comparator, coupled to an output of the third signal processor that generates the weighted pressure sum signal, configured to generate a pressure sum error signal that corresponds to whether the pressure sum signal is less than a threshold signal ε; and

e g. a fourth signal processor, coupled to an output of the comparator, configured to generate a coefficient signal based on the pressure sum error signal, which coefficient signal is input to the second signal processor which is further configured to generate an output signal that is proportional to the estimate of derivative signal with a proportionality that is based on the coefficient signal.

88. The apparatus of claim 87, the fourth signal processor configured to generate a coefficient signal that results in the pressure sum being no greater than the threshold signal ε.

89. The apparatus of claim 87, the fourth signal processor coupled to an output of the array further configured to generate the signal that corresponds to pressure sum as a sum of unequally weighted outputs of sensors of the array.

90-92. (Cancelled)

93. (Original) An apparatus for transducing sound produced by a talker at a talker location, the apparatus comprising:

a. an array of at least two pressure sensors spaced apart along a sensor axis and located at an array location;

b. a loudspeaker, at a loudspeaker location that is on the sensor axis;

c. a signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to an estimate of pressure derivative, approximately along the sensor axis, at the array location;

d. a signal processor, coupled to an output from the array of pressure sensors, configured to generate a signal that corresponds to a weighted sum of an acoustic parameter at the array location, the weighting chosen to establish a directional sensitivity to the pressure sensor array to discriminate in favor of sound coming from the direction of the talker location;

e. a comparator, coupled to an output of the signal processor that generates a weighted sum signal, configured to generate an error signal that corresponds to a difference between the weighted sum of the acoustic parameter and a threshold ε;

f. a signal processor, coupled to an output of the comparator, configured to generate a coefficient signal based on the error signal, which coefficient signal is input to a signal generator that has an input that is coupled to an output of the signal processor that generates an estimate of derivative signal and an output that is coupled to the loudspeaker input, the signal generator being further configured to generate an output signal that:

        i. is proportional to the derivative signal with a degree of proportionality that is based on the coefficient signal; and

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ii. results in the weighted sum of the acoustic parameter being no greater than the threshold ε.

94. (Original) An apparatus for transducing an acoustic signal produced by a source, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from a long to a short, the apparatus comprising:

a. a pressure sensor located at a sensor location, on a sensor line from a source input portion, which sensor is configured to generate a signal that is proportional to sound pressure;

b. a loudspeaker that is configured to output sound waves in response to an input, at a loudspeaker location that is on the sensor line;

c. a first signal processor, having an input that is coupled to the pressure sensor and having an output signal that is proportional to the pressure signal, which output signal is coupled to:

i. the loudspeaker input; and

ii. a comparator, configured to generate a pressure error signal that corresponds to whether the pressure signal is less than a threshold signal ε; and

d. a second signal processor, coupled to an output of the comparator, configured to generate a coefficient signal based on the pressure error signal, which coefficient signal is input to the first signal processor, which is further configured to generate an output signal that is proportional to the pressure

signal with a proportionality that is based on the coefficient signal.

95. (Original) A method for transducing an acoustic signal produced in an acoustic medium by a source at a source location, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from long to short, the method comprising the steps of:

a. measuring sound pressure at at least two locations along a sensor axis that passes through the source location, at an array location, spaced from the source location;

b. based on the measured sound pressure, estimating a sound pressure derivative along the sensor axis at the array location, and generating a signal that is proportional thereto; and

c. driving a loudspeaker, located on the sensor axis, spaced away from the source location farther than is the array location, with a signal that is proportional to the estimated sound pressure derivative signal.

96-137. (Cancelled) Cancel claims 96-137 without prejudice.

138. (Currently amended) A method for transducing an acoustic signal produced in an acoustic medium by a source at a source location, the signal having a frequency within a range from a low to a high, and corresponding wavelength within a range from long to short, the method comprising the steps of:

a. measuring acceleration of the acoustic medium, along a line that passes through the source

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location, at a sensor location, spaced from the source
location;

b. generating a signal that is proportional to
the measured acceleration;

c. driving a loudspeaker, located on the sensor
axis, spaced away from the source location farther
than is the array location, with a signal that is
proportional to the acceleration signal;

~~The method of claim 135, further comprising the steps
of~~;

a d. using an array of at least two pressure
sensors spaced apart along a sensor axis that is
collinear with the line, and located at an array
location that is spaced from the loudspeaker location
along the line;

b e. generating a signal that corresponds to a
weighted source pressure sum of outputs from the at
least two sensors;

c f. comparing the weighted source pressure sum
to a threshold signal ε and, based on the comparison,
generating a pressure sum error signal that
corresponds to whether the pressure sum signal is less
than the threshold;

d g. generating a coefficient signal based on
the pressure sum error signal; and

e h. generating an output signal that is
proportional to the estimate of derivative signal,
with a proportionality that is based on the
coefficient signal.

139-149. (Canceled) Cancel claims 139-149 without prejudice.